

REMARKS/ARGUMENTS

Claims 1-6, 8-13 and 15-26 are active. Claims 15, 19, 25 and 26(constructively) are withdrawn.

The claimed invention provides a photovoltaic device useful for converting light energy to electrical energy, which is efficient in terms of energy conversion, converts light of longer wavelength than conventional devices, and is made from lower cost organic materials than conventional devices.

The photovoltaic device according to the claimed invention contains a composition of carbon nanotubes and of at least one organic hole conductor. Because the carbon nanotubes have band gaps which lie in the range of from about 0.5 to about 1 eV, the photovoltaic device according to the claimed invention can convert light of low energy to electrical energy.

The rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24 under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103(a) over Kymakis et al. (Applied Physics Letters, American Institute of Physics. New York, Us vol. 80, no. 1,7, pages 112-114) with support of Vinciguerra et al. (U.S. 7,329,902) is respectfully traversed.

Applicants respectfully note that the above-identified application is the national stage of PCT/EP04/08105, filed July 20, 2004, and therefore the effective filing date of this application is July 20, 2004. Priority is claimed to EP Application No. 03018466.7, filed August 14, 2003. Vinciguerra was first published as EP 1487030 on December 15, 2004, which is after the effective filing date of the present application. As the effective filing date of the application antedates the first Vinciguerra publication, this reference is not available as a reference.

Kymakis describes a photovoltaic device containing poly(3-octylthiophene) and single walled carbon nanotubes. Fig. 2 shows the Absorption spectra of the composite and in discussing the spectra, states:

“The absorption spectra of the P3OT show no significant change upon adding 1% of nanotubes by weight. This implies that in the blend, no significant ground state interaction is taking place between the two materials, . . . From the absorption spectra of the P3OT, an optical band gap of 2.4 eV can be derived.”

Further, on page 114, left column, lines 16-25, Kymakis describes that the workfunction of SWNTs ranges from 3.4 to 4 eV. **Nowhere does this reference disclose or suggest carbon nanotubes having a band gap from about 0.5 to about 1 eV.**

A proper finding of anticipation requires that “[e]very element of the claimed invention . . . be literally present, arranged as in the claim. *Perkin-Elmer Corp.*, 732 F.2d at 894, 221 USPQ at 673; *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771-72, 218 USPQ 781, 789 (Fed. Cir. 1983), *cert. denied*, 465 U.S. 1026 [224 USPQ 520] (1984). The identical invention must be described in as complete detail in the reference as is described in the claimed invention.

The Office has cited Vinciguerra as a “teaching reference” (Official Action dated February 17, 2009, page 2, last line). Applicants note that as indicated above, Vinciguerra is not available as a prior reference.

Vinciguerra describes a light emitting device wherein carbon nanotubes serve as a conduit for hole and electron recombination and emit light in the IR region (Col. 4, lines 25-30). The Office has pointed to this reference to show SWNT band gap range of 0.5-1.0 eV (Official Action dated February 17, 2009, page 3, lines 4-5).

However, the Office has not explained how or why one of ordinary skill in the art of photovoltaic devices which absorb light energy and convert it to electrical energy would reach to LED technology.

When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than hindsight gleaned from the invention itself. *Interconnect Planning Corp.* 774 F.2d, 1143, 227 USPQ 551.

Something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co.* 730 F.2d 1452, 1462, 221 USPQ 481, 488 (Fed. Cir. 1984)

Applicants respectfully submit that only in hindsight, in view of the claimed invention, would one of ordinary skill in the art combine the cited references or use the teaching of Vinciguerra. The Office has not provided any reasonable explanation of how or why one of ordinary skill in the art would have combined the cited references to obtain the claimed invention, at the time of the present invention.

Applicants note that in reversing an obviousness rejection in *Ex parte* SUSUMU TANAKA and YASUO MURAKAMI (Appeal 2007-3845; Decided: March 28, 2008) the Board of Patent Appeals and Interferences stated:

In order to establish a prima facie case of obviousness, the Examiner must show that each and every limitation of the claim is described or suggested by the prior art or would have been obvious based on the knowledge of those of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). “[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)

Applicants particularly note that Kymakis is completely silent with respect to the band gap of the carbon nanotubes. Applicants further note that as known in the art, carbon nanotubes can be “tuned” and the band-gap can have a broad range. The Office previously cited Ago et al. (Official Action dated October 20, 2008, page 4, lines 7-16) and as an indication of the art, this reference (page 1285, footnote [13]) describes a band-gap range for

photovoltaic devices of 3-14 meV. This range is nearly 100-fold smaller in terms of wavelength requirement (higher energy radiation) than the band-gap of the present invention.

Vinciguerra cites varied band-gap values (Col. 7, lines 60-64) and the reference in Col. 4 describes the “luminescence phenomena.”

In a Precedential Opinion rendered by the Board of Patent Appeals and Interferences in *Ex parte Whalen II* (Appeal 2007-4423, Application 10/281,142) on July 23, 2008, the Board stated:

“The KSR Court noted that obviousness cannot be proven merely by showing that the elements of a claimed device were known in the prior art; it must be shown that those of ordinary skill in the art would have had some “apparent reason to combine the known elements in the fashion claimed.””

“The Examiner has not persuasively explained why a person of ordinary skill in the art would have had a reason to modify the compositions taught by Evans, Greff’767, or Taki in a way that would result in the compositions defined by the claims on appeal. Therefore, The Examiner has not made out a prima facie case of obviousness under 35 U.S.C. § 103.”

For all the above reasons, Applicants respectfully submit that the cited reference can neither anticipate nor render obvious the claimed invention. The secondary teaching reference is not available as a reference and even if considered, a prima facie case of obviousness cannot be supported. Accordingly, withdrawal of the rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24 under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra is respectfully requested.

The rejection of Claim 5 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Tsukamoto et al. (JP 2003-096313) is respectfully traversed.

Claim 5 directly depends from Claim 1 and includes all the description of the independent claim. The deficiencies of the primary references relative to anticipating and/or

rendering obvious the invention described in Claim 1 and claims dependent thereon is described above. Tsukamoto neither discloses nor suggests a device according to the claimed invention wherein a band gap of said carbon nanotubes lies in the range of from about 0.5 to about 1 eV and therefore does not cure the deficiencies of the primary references.

Tsukamoto describes a Field Effect Transistor wherein a composite of carbon nanotubes and organic polymer is used as a semiconductor. This reference is silent with respect to a band gap for the carbon nanotubes and as shown by the Ago reference cited above, carbon nanotubes are generally known to have band gaps of 3-14 meV. Therefore, a band gap of 0.5 to about 1 eV cannot be inherent to the description of this reference and, as indicated, the cited combination of references cannot render the claimed invention obvious. Accordingly, withdrawal of the rejection of Claim 5 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Tsukamoto is respectfully requested.

The rejection of Claims 11 and 12 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Forrest et al. (U.S. 6,451,415) is respectfully traversed.

The deficiencies of each of the cited primary reference combination has been described above. Forrest describes photodetector organic photosensitive optoelectronic devices having multilayer structures and an exciton blocking layer. This reference is cited to show a multilayer structure. However, Forrest does not disclose or suggest multilayers containing carbon nanotubes having a band gap in the range of from about 0.5 to about 1 eV and therefore Forrest does not cure the basic deficiencies of the primary reference combination. Withdrawal of the rejection of Claims 11 and 12 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Forrest is respectfully requested.

The rejection of Claim 20 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Ganzorig et al. (Alkali metal acetates as effective electron injection layers for organic electroluminescent device," Materials Science and Engineering B,

Application No. 10/567,929
Reply to Office Action of February 17, 2009

Elsevier Sequoia, Lausanne, Ch, vol. 85 no. 2-3, 22 August 2001 (2001-08-22), pages 140-143) is respectfully traversed.

Ganzorig is cited to show a coating layer of alkali metal acetate of fluoride on an electrode. This reference describes a coating applied at the interface of an aluminum/tris(8-hydroxyquinoline)aluminum electrode/transfer layer. Nowhere does Ganzorig disclose or suggest a composite of carbon nanotubes and of at least one organic hole conductor, wherein the band gap of the carbon nanotubes lies in the range of from about 0.5 to about 1 eV.

In view of the above, Applicants respectfully submit that Ganzorig does not cure the basic deficiency of Kymakis with support of Vinciguerra previously described, and therefore, the cited combination of references cannot render the claimed invention obvious. Accordingly, withdrawal of the rejection of Claim 20 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Ganzorig is respectfully requested.

Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

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